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SOIL CONSERVATION SERVICE

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EROSION CONTROL PRACTICES DIVISION

Summary of the Study of the Economics of Conservation Farming in Illinois - E. L. Sauer, Urbana, Illinois.-"Economic studies of conservation to date have not given all of the answers to the problem by any means. But, they have rather definitely pointed out these significant facts:

"Farms with high conservation scores tend in Illinois to follow a complete conservation plan, including (1) testing and treating the soil, (2) using the land according to its capabilities, (3) using rotations with ample acreages of deep-rooted legumes, and (4) using proper water disposal practices, such as grass waterways, contouring, strip cropping, terracing, tile and open-ditch drainage where needed. These farms also tend to utilize forage crops through livestock.

"With regard to specific water disposal practices used, we find the results of such a program to be that contour farming increases crop yields, reduces soil and water losses, and on the average does not increase total farm operating costs. With regard to the total farm business, we find that conservation plans do not necessarily increase earnings immediately. Considerable effort and money must usually be expended before positive results are achieved. Our evidence indicates, however, that long-time benefits from conservation are certain.

"Comparisons of farms having conservation plans with otherwise comparable farms that do not, show that the conservation farms have spent more money for soil and related improvements, have more land in legumes and grasses, have higher crop yields, produce more and better quality hay and pasture, feed more livestock, have higher livestock production and returns, and secure larger net farm incomes.

"In all comparisons livestock efficiency, as measured by 'returns per $100 of feed fed,' was higher on the high-conservation farms than on the others. Does this mean that the operators on the high-conservation farms were better managers, that they fed better feed, or what? It can be argued--

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although our studies have not proved it--that better feed supplies--grain, hay and pasture--on the conservation farms are responsible for the greater livestock efficiency. In getting progress in agriculture--and conservation farming, represents progress--it is important to get farmers to adopt systems which, in the hands of the average operator, achieves general progress. And a large number of farmers are average operators. Systems that conserve soil and water bring better crop yields, make the land easier to work, and apparently (although this is a tentative conclusion) provide better feed supplies, one of the bases for more efficient livestock production.

"Although, for a year or more after a conservation plan is adopted, net income may be lower than it would ordinarily be, studies made in different areas of the state show that money spent on conservation is a sound investment. In addition to improving both present and future productivity, conservation practices usually increase the net income in one to four years, depending on the extent of the farm's conservation needs. The returns provide a safe basis for establishing credit to put the conservation program into effect. Although the net income may be reduced temporarily, the productive value of the land increases immediately, protecting the financial position of the landowner until the long-time benefits of conservation can accrue. With our increasing population and present declining resources, investments in soil conservation should continue to pay high dividends.

Irrigation of Alfalfa - T. C. Peele, Clemson, S. C.-"Tests to study the effects of irrigation on yields and quality of alfalfa hay and moisture requirements of alfalfa were initiated in 1947. Two acres of alfalfa were planted on an area of Cecil sandy loam and fertilized with 1000 pounds of 4-10-6 fertilizer, 700 pounds of manure salts and 20 pounds of Borax per acre. After the second cutting on June 1, 1948, 1000 pounds of 3-12-12 fertilizer and 10 pounds of borax per acre were applied.

"A sprinkler system was used to apply from 1.5" to 2.0" of water per irrigation at the rate of 0.5" per hour, the approximate infiltration rate of the soil.

"Two moisture levels were maintained by irrigation and a third treatment was unirrigated. Four plots were used for each treatment. One irrigated treatment received additional water when 50% of the total water available to the plants at the 8" depth had been dissipated, and the second when 50% of the 18" depth had been used. Gypsum electrical resistance blocks were used to study moisture condition and to determine the time for irrigation.

"The yields from the three treatments and the water received by each are shown in Table 1. The yields from the irrigated treatments are significantly higher than the unirrigated for the first and second cuttings on June 1 and July 19. There are no significant differences between the yields from the irrigated and unirrigated for the third and fourth cuttings on August 26 and October 6. The lower yields for these cuttings were caused by considerable insect and worm damage.

Table 1.--Yields of hay from irrigated and unirrigated alfalfa, 1948

Period of Growth	Unirrigated		Irrigated (1)		Irrigated (2)		Least significant difference at 5% level
	Rainfall Inches	Yield Tons/Acre	Rainfall Irrigation Inches	Yield Tons/Acre	Rainfall Irrigation Inches	Yield Tons/Acre	Tons
April 16 - June 1	4.88	0.27	10.13	1.06	8.13	0.97	0.12
June 2 - July 19	7.15	0.93	9.15	1.24	9.15	1.12	0.20
July 20 - August 26	5.80	0.84	7.30	0.83	5.80	0.74	0.22
August 27 - October 6	3.92	0.44	6.92	0.59	5.92	0.30	0.16
TOTAL	21.75	2.48	33.50	3.72	29.00	3.13	

(1) Irrigated when 50% of the total water available to the plants remained in the soil at the 8" depth.

(2) Irrigated when 50% of the total water available to the plants remained in the soil at the 18" depth.

Note: On April 15, before any irrigations had been made, 0.87 tons per acre was harvested from the whole area.

"Under the field conditions of the 1948 growing season, approximately 8 to 10 inches of water were required to produce one ton of alfalfa hay or about 1.5 to 2 inches of water per week."

Irrigation of Field Corn - T. C. Peele, Clemson, S. C.-"Field corn has been irrigated for the past three years. During 1946 and 1947 approximately two acres of a hybrid corn, Funk's G-714 were planted and fertilized with 2100 pounds of 4-10-6 fertilizer plus the equivalent of 200 pounds nitrogen per acre. In 1947, muriate of potash was added at the rate of 250 pounds per acre. Four varieties, Dixie 17, Wood's V-125, Douthit's Prolific and Funk's G-714 were planted in 1948.

"A sprinkler irrigation system was used to apply supplemental water at the rate of 0.5" per hour, and 1.25 to 2.00 inches total were applied per irrigation. Gypsum electrical resistance blocks were installed at 8 and 18 inches depths in both the irrigated and unirrigated areas to study moisture relations, and to determine the time of irrigation.

"Two blocks of approximately 0.5 acre each were irrigated in 1946 and 1947 and two blocks of the same size were unirrigated. Irrigations were made when 50-60% of the total available water had been used. Three treatments, with 5 plots in each treatment, were made in 1948. One treatment was irrigated when 50% of the total available water remained in the soil at the 8 inch depth, one when 25% of the total available water remained in the soil at the 8 inch depth and the third was unirrigated.

"Table 1 shows yields of Funk's G-714 for the three years from the irrigated and unirrigated plots and water each treatment received. Table 2 gives the yields of the four varieties planted in 1948 from the irrigated and unirrigated plots. Dixie 17 and Funk's G-714 appeared to respond to irrigation more than the Wood's V-125 and Douthit's Prolific. However, there were no significant differences between the yields from the irrigated and unirrigated treatment.

Table 1.--Corn Yields from Irrigated and Unirrigated Areas.

Year	Rainfall During Corn Growing Seasons	Water Added by irrigation	Corn Yields	
			Unirrigated Plots	Irrigated Plots
	Inches	Inches	bu./acre	bu./acre
1946	23.37	3.00	116	138
1947	9.41	5.30	22	110
1948	23.37	4.00	113	117
Average	18.72	4.10	84	122

Table 2.--Yields from irrigated and unirrigated corn varieties, 1948, in bushels per acre

Variety	Unirrigated	Irrigated*	
		A	B
Dixie 17	123	130	131
Funk's G-714	113	113	123
Wood's V-125	99	106	101
Douthit's prolific	87	84	92

Note: Rainfall for the growing period was 23.37". An additional 4.00" of water was added to the irrigated plots.

* The A treatment was irrigated when the available water in the soil was reduced to 50% at the 8 inch depth and the B treatment when it reached 25% at this depth.

Late Turning Versus Early Turning of Winter Cover Crops - C. S. Britt, Beltsville, Maryland.-"Late turning of winter cover crops on tobacco land greatly increases the amount of top growth produced by the covers. Air-dry weights of early turned and late turned covers are compared in table 1.

Table 1.--Air-dry weight of top growth of cover crops turned early and late - 1 year tobacco rotations. Beltsville, Maryland, 1948.

Kind of Cover Crop	POUNDS PER ACRE 1/		
	Early Turned April 13	Late Turned May 19	Increase due to Late Turning
Wheat & Vetch	1,154	7,294	6,140
Vetch	527	4,301	3,774
Rye grass	263	3,485	3,222
Rye & vetch	1,600	12,069	10,469
Ryegrass and Nitrogen 2/	527	5,781	5,254
Ryegrass and vetch	527	5,029	4,502

1/ Average of two samples.
2/ 20 lbs. nitrogen (as ammonium sulphate) per acre applied April 8, 1948.

"The late turning of wheat, rye or ryegrass gives a residue with considerable resistance to decomposition and the residues are still visible in and on the soil in late September when the new covers are planted.

"The cover crop plots generally give lighter volume weights of soil than the plot with no cover. Also, the late turned cover plots tend to give lighter weights than the early turned cover plots. These volume weights are given in table 2.

Table 2.--Volume weights of soil (3 to 6 inch depth in ridge) following early and late turning of cover crops - 1 year tobacco rotation. Beltsville, Maryland, September 16, 1948.

Kind of Cover Crop	Volume Weights in Soil 1/	
	Early Turned - April 13	Late Turned-May 19
None	1.53	--
Vetch	1.47 2/	1.38
Ryegrass	1.40	1.31 2/
Ryegrass and vetch	1.33	1.34
Rye and vetch	1.34	1.30

1/ Average of 5 samples.
2/ Average of 10 samples.

Effect of Erosion at Marcellus 1939-1942 Still Apparent - G. R. Free, Marcellus, New York.-"The corn yields for 1948 from the plots at Marcellus, which were fallow from 1939-1942 and lost 270 tons per acre, or 2 inches of soil, during that period, were approximately 85% those from plots which were in meadow during that time and lost only 1.3 tons per acre. All of these plots in 1948 received 1,000 pounds per acre of 10-10-10. Yields since 1942 for the eroded plots, expressed as a percentage of those from the ex-meadow plots, have been as follows:

Crop and Year	Treatment	Yields, Percent
Corn, 1943	Manure & superphosphate	47
Oats, 1944	Superphosphate	70
Alfalfa Timothy hay, 1945	None	92
Alfalfa Timothy Hay, 1946	None	86
Corn, 1947	Manure & superphosphate	70
Corn, 1948	1,000 lbs. per acre 10-10-10	85

Irrigation Increases Potato Yields at the Arnot - E. A. Engdahl.-

Water source	Yield, bushels per acre					
	One ton 5-10-10			Two tons 5-10-10		
	12"	18"	36"	12"	18"	36"
Rain only	323	393	291	437	430	344
Rain plus 2.8"	372	351	333	433	457	383
Rain plus 3.7"	386	382	354	478	458	355
Ave. increase from irrig.	56	-29	53	19	28	25

"The rainfall for June, July, and August was almost ideal -- 4.5, 4.0, and 3.7 inches, respectively. However, there was a dry period the latter part of August and first part of September. The potatoes were irrigated at this time in sufficient amounts to maintain as near as possible field capacity at the high rate of application.

"In general, the 18" spacing with high fertilization and water application showed up as being the most promising. All plots showed good vine growth, having an excellent canopy for soil protection during heavy rains. Tops died down in the order of water and fertilizer application; the highly fertilized plots remained green at the beginning of the harvest."

Effect of a tobacco crop on soil moisture - Roy C. Dawson, College Park, Md.-"The nitrate content of the soil prior to and at different intervals after, transplanting tobacco is shown in the following table. The tobacco was transplanted on June 25, 1948. On June 8-11, before transplanting, the nitrate content was about the same throughout the five-foot depth in plots with and without tobacco. On July 6-12, approximately two weeks after transplanting, there was still no appreciable difference between the nitrate content of plots with and without tobacco. However, the August, September, and October samplings showed much greater amounts of nitrates in plots which were free of growing plants. The young tobacco showed no noticeable effect on soil nitrates two weeks after transplanting. Six and one-half weeks after transplanting, the nitrate content of the top foot of soil was greatly reduced by the vigorously growing plants. The data indicate that a slight increase, probably of questionable significance, resulted in the nitrate content of the top foot of soil after removal of the tobacco crop. This is shown by the nitrate content of 0.89 ppm in the 0-1' depth of the tobacco plots on August 9-11, before removal of the crop, as compared to 1.18 and 2.87 ppm 5-6 days, and 42-44 days, respectively, after removal of the tobacco crop. The tobacco was grown following spring plowing of an alfalfa-brome sod.

"During the June and July samplings the greatest amount of nitrates was found in the top foot of soil when the added plant residues were concentrated. As the season progressed, the nitrates gradually moved downward. During the August sampling, which was preceded by 8.41 inches of rainfall, there was a considerable increase in the nitrate content of the second foot of soil when no tobacco was grown, and in the third, fourth and fifth foot depths of plots with or without a growing tobacco crop.

Distribution of Nitrate Nitrogen (ppm) in Profile of Alfalfa-Bromegrass Plots with and without Tobacco at Different Dates after Transplanting

Notes	Preceding Rainfall Inches*	Crop	Depth of Sampling 0-1'	1-2'	2-3'	3-4'	4-5'
Before transplanting tobacco	7.28			June 8-11, 1948			
		None	3.70	3.53	1.19	0.53	0.61
		None	4.42	2.90	1.24	0.60	0.65
Approximately 2 weeks after transplanting	5.92			July 6-12, 1948			
		Tobacco	9.86	4.26	2.08	1.08	0.84
		None	9.06	3.59	1.94	1.25	0.76
Approximately 6-1/2 weeks after transplanting	8.41			August 9-11, 1948			
		Tobacco	0.89	3.03	2.53	1.69	1.18
		None	6.72	10.80	5.11	1.79	1.31
5-6 days after harvest of tobacco	2.90			September 13-14, 1948			
		Tobacco	1.18	0.90	2.64	1.70	1.39
		None	6.49	7.18	5.00	2.94	1.92
42-44 days after harvest of tobacco	4.66			October 20-23, 1948			
		Tobacco	2.87	1.85	0.87	1.40	0.93
		None	7.38	6.10	3.52	3.23	1.86

* Amount of rainfall since last sampling date. Samples were taken about one month apart.

The Effects of Rye Cover Crop, Corn Stalk Mulch, and Land Resting on Sweet Potato Yields - O. R. Neal, New Brunswick, N. J.-"The experiment which has been running four years was designed to study the effect of corn stalk mulch for sweet potato production and the value of a year of land resting on sweet potato yields. A rye cover crop was also used as a means of controlling erosion and adding organic matter to the soil.

"The land resting treatment in 1944 consisted of a rye winter cover crop disced down in the late spring, soybeans drilled, and the beans disced down in the fall and another rye cover crop seeded. The land was not plowed during this operation. A similar treatment using broadcast field corn in place of soybeans was applied to two additional plots in 1947. On all treatments vine type sweet potatoes occupy half of the plot and bush type occupy the other half.

"In 1948 the mulch was not applied to the sweet potatoes and the land resting treatment of rye cover crop, soybeans, and rye cover crop was repeated on the two plots previously rested in 1944.

"Average sweet potato yields under the treatments listed are shown in the following table for the years 1945, 1946, and 1947 as well as the yield for 1948.

Treatment	Yield U. S. No. 1's - Bu. per acre			
	Vine type		Bush type	
	3-year ave.	1948	3-year ave.	1948
None	92	172	92	150
Rye cover crop	102	261	113	216
Corn stalk mulch until 1948	64	211	58	212
Rested 1944 and 1948	108		119	
Rested 1947		262		289

"Prior to 1948 the yield on plots with corn stalk mulch has been reduced but by not applying it in 1948 the yield was substantially increased over the check plots. This tends to confirm our explanation that the mulch material absorbs considerable amounts of water during light rains which later evaporates, thus robbing the plants of moisture which might have entered the soil had there been no mulch.

"As in previous years the bush type sweet potatoes responded to the resting treatment more than did the vine type."

Forage Yields in Relation to Grass Mixtures and Number of Clippings - C. J. Whitfield, Amarillo, Texas.-"Forage production for 1948 was above average reflecting the increased amount of precipitation received. When the final clippings were made December 13 and 14, the blue grama and buffalo grass was mature, with no green forage. Western wheatgrass, just starting new growth, had 1 to 2 inches green forage, while crested wheat had 5 inches new growth.

Forage Production for 1948

Pasture	Grass	Total Lbs. Forage/Acre	Lbs. forage/acre 3/18-12/13/48
I-1	Blue grama and buffalo	837**	716*
H	Blue grama and buffalo	574**	513*
H	Western wheat	1,485**	878*
I-2E	Blue grama, buffalo and western wheat	1,151**	742*
I-2W	Blue grama, buffalo and western wheat	1,620**	972*
F	Western wheat	1,452**	742*
I-4	Crested wheat	1,012**	641*

* These plots clipped March 18, 1948 and December 13, 1948
** These plots were only clipped December 13, 1948.

Forage Yields in Relation to Soil Treatments - Richard M. Smith, Puerto Rico.-"Some forage yield data are summarized by Mr. Telford in the two following tables:

Table 1.--Forage Yields from Surface Treated Native Pasture at the Federal Station, November 1, 1948 to January 3, 1949.

Treatment* (6 replicates)	Dry Wt. Yields lbs./acre	Desirable Species** % by Wt.
Lime	516	55
P	420	22
LP	642	18
LPK	726	42
LPKN	1158	86

* First treatment - Early May, 1948
Nitrogen treatment repeated November 1, 1948

** The desirable species were mostly tropical carpet grass (axonopus compressus) and 'beggar weed' legumes (Desmodium sp.). The undesirable species include cortodera (Paspalum millegrama), mallow (Malvastrum spicatum), dropseed (Sporobolus indicus), sensitive plant (Mimosa pudica), and several species of trees and shrubs. Cages are being placed to obtain yields on untreated plots of this native pasture.

Table 2.--Forage Yields from Dairy Pasture Management Study, Nov. & Dec. 1948

Pasture Number	Treatment*	Dry Wt. Yield lbs./acre	Species Composition and explanations
3	None	1851	Molasses grass-90% Kudzu - 10% Previously in Molasses grass
6	None	2063	Molasses grass - 20% Kudzu - 50% Weeds - 30% Previously in Kudzu
1	LP	3296	Molasses grass - 70% Kudzu - 30% Previously in molasses grass
4	LP	3025	Molasses grass - 45% Kudzu - 55% Previously in Trailing Indigo
7	LP	3424	Molasses grass - 35% Kudzu - 65% Previously in Kudzu
2	LPK	3313	Molasses grass - 60% Kudzu - 40% Previously in Trailing Indigo
5	LPK	2939	Molasses grass - 65% Kudzu - 35% Previously in Molasses grass
8	LPK	3456	All grass - 15% Kudzu - 75% Weeds - 10% Previously in Kudzu

* Treated and seeded early in Spring, 1948.
Cow days of grazing on each pasture are available but are not summarised as yet.

"Species and ground cover estimates on two other areas of treated, native pasture show a definite response to N, but none to LP or to LPK as yet."

Progress in Study of Structure of Tropical Soils - "We think that we are making some progress toward a fundamental understanding of the nature and the causes of the famous structure of tropical soils. Detailed observations of soil profiles in the field and of samples in the laboratory are of considerable assistance. Pore space analyses are providing supporting evidence. In addition, we are using modifications of Middleton's dispersion ratio, and of McCalla's water drop determination of test aggregate stability. Wet sieving has not proved satisfactory because of the great stability of most lumps or clods or aggregates being studied. The McCalla method can only be used by greatly increasing the intensity of the water drop energy application.

"Earthworm casts constitute a very important part of the aggregates in many surface soils, and these are extraordinarily stable by the methods used. However, earthworms do not seem to be a primary factor influencing the natural structure of soil profiles. Their main importance seems to be in regenerating a favorable aggregation at the soil surface.

"Unpublished physical data of Dr. Bonnet are of great assistance in helping us to understand the various soil structure relationships."

Corn Yields in Relation to Cropping Systems and Tillage Practices - F. L. Duley, Lincoln, Nebraska.-"The corn plots at Lincoln and Hastings were all harvested and the corn shelled and moisture determinations made. Tables 1 and 2 show the yields for the various treatments. The results this year further emphasize the point that the stubble mulch system is relatively more effective in rotations that supply large amounts of leguminous material for maintaining the nitrate content.

"On the Hastings Project the corn was badly damaged by the extremely hot weather during the last week of August. The yields were low, but it will be seen that under these conditions stubble mulching was more effective in bringing corn through a period of dry weather. The effect of stubble mulching depends largely upon just when the dry weather hits the crop and the degree of severity. It has been repeatedly shown that stubble mulched corn usually withstands more drought than where the land is plowed. That is, it will resist drought a little longer. If the drought is broken after the corn on plowed land has been greatly affected but while the subtilled is still holding on, there may be considerable difference in favor of stubble mulching. This is what happened on the Hastings Project this year.

Table 1.--1948 Yields of Corn in Different Cropping Systems at Lincoln, Neb.

Cropping System	Plowed	Subtilled	Decrease compared with plowed
	Bu./A.	Bu./A.	Bu./A.
High Fertility Level - Legumes in Rotation			
1. Corn after sorghum after 2-year sweetclover	90.5	88.6	1.9
2. after old alfalfa	83.9	85.9	+ 2.0
3. after 2-year sweetclover	87.5	81.6	5.9
4. after corn after 2-year sweetclover	86.1	78.4	7.7
5. after corn after 1-year sweetclover	83.9	78.1	5.8
6. after oats with sweetclover	80.1	77.6	2.5
7. after wheat after 2-year sweetclover	84.2	77.2	7.0
8. after wheat after oats after 2-year sweetclover	77.5	77.4	0.1
9. after 1-year sweetclover	52.9	71.5	+18.6
Mean	80.7	79.6	1.1
Mean exclusive of 9	84.2	80.6	3.6

Low Fertility Level - No Legume in Rotation

Corn after wheat after oats, 10th year:	Bushels per acre
On continuous subsurface tillage	39.4
On subsurface tillage for corn and oats, plowed for wheat	43.7
On spring plowed for corn, subtilled for wheat and oats	49.1
On fall plowed for corn, continuous plowing, all residues removed	51.9
On fall plowed for corn, continuous plowing, all residues returned	54.9

Table 2.--1948 Yields of Corn in Different Cropping Systems, Hastings, Neb.

Cropping System	Subtilled	Plowed	Increase for Subtillage
	Bu./A.	Bu./A.	Bu./A.
Sweetclover 2 years, corn	19.6	6.1	13.5
Sweetclover 2 years, oats, wheat, corn	11.7	0.7	11.0
Sweetclover 2 years, wheat, corn	2.7	1.9	0.8

Crop Production Increased by Level Terrace - R. E. Dickson, Spur, Texas.-"Holding one dashing rain of 3.86 inches that fell in June of 1948 paid big dividends, even though rainfall for the year totalled only 14.33 inches. Cotton and cottonseed from an area with closed level terraces brought $67.17 per acre while cotton grown on straight rows with 1/2 of 1 percent slope brought $38.17. Over a 22-year period the closed level terraced area has produced $752.60 in cotton per acre or an increase of $248.12 over returns from cotton grown on straight rows up and down 1/2% slope. There has been no erosion on the closed level terraced area for a 22-year period

Heavy Applications of Manure Sorghum Litter, or Clover Straw Greatly Increased Productivity of Native Buffalo Grass - Results from experiments with commercial fertilizers, manure, sorghum litter and clover straw to increase productivity of native buffalo grass on Weymouth clay loam soils show that heavy applications of litter, either sorghum, clover straw or manure all increased the yield of grass from 3 to 4 times of that produced on untreated areas during seasons of 1946, 1947 and 1948. The manure was not any more effective than sorghum litter (old silage) for increasing the yields of grass. Complete fertilizers, such as 4-12-4 at 100, 200, and 400 lbs. per acre or nitrogen and phosphorous drilled into the sod also failed to increase the yield of grass. Soil moisture determinations made following heavy rains showed that heavy applications of litter greatly increased the absorption and penetration of moisture and reduced the amount lost by evaporation from the soil surface."

Utilization of stubble in Dryland Wheat Farming in Relation to Protein Content of the Wheat Produced - Hugh C. McKay, St. Anthony, Idaho.-"The utilization of stubble in some areas of dry land wheat farming has a serious depressing effect on nitrate production which results in lower yields. In southeastern Idaho the utilization of stubble has resulted in only a slight depressing effect on nitrate development which did not effect the wheat yield but it did effect the protein content of the wheat as shown by the following table.

Percent protein of wheat from various residue and tillage treatments.
Tetonia Experiment Station

Type of Plow Used	Stubble Burned	Stubble Utilized	Average
Moldboard	16.97	15.07	16.02
One way disk	15.96	14.76	15.36
Modified Moldboard	15.45	14.29	14.87
Average	16.13	14.71	
Fall plow moldboard		17.21	
One way disk 75 lb. Am. Sul.		15.90	
2000 lb. Straw		14.68	
4000 lb. Straw		13.69	

"The above data shows that the utilization of stubble has a depressing effect upon protein content of the wheat. The highest percent of protein 16.97% is found where the stubble is left on the surface with the modified moldboard plow. In comparing the average of the 3 plows, the moldboard gives the highest percent protein, the one way disk next and the modified moldboard gives the least.

"Fall plowing with the moldboard gives a higher percent protein than any other method.

"The application of 75 pounds of ammonium sulphate brought the percent protein up to 15.9 as compared to 14.76 for the one way disk where no fertilizer was used.

"The application of 2000 lbs. of straw depressed the protein content somewhat but the least protein was found under the 4000 lbs. straw application."

Progress in the Utilization of Protective Ground Cover by Grazing - J. R. Johnston, Temple, Texas.-"On December 7th, 31 of the steers used in the 1948 livestock utilization of grasses and legumes studies were sold on the Fort Worth market at $26.50/CWT. These 31 steers were grazed on oats, sweetclover, sudan grass, and sudan grass from March through August. These steers were fed in dry lot from September to December 7th.

"The 31 steers sold on December 7th yielded an average of 59.1 percent dressed carcass. Twenty-seven of these steers graded choice and 4 graded good.

"The 18 steers used to graze improved and unimproved Bermuda-Buffalo grass were placed on feed in October and will not be ready for market until March. The permanent grass pasture steers weighed approximately 100 lbs. per steer less than the temporary pasture when they went to the feed lot."

Corn Yields in Relation to Methods of Seedbed - G. M. Browning, Ames, Iowa.-"The effect of different methods of seedbed preparation with and without fertilizer were continued in western Iowa in 1948. The yields and stands are summarized in the following tables in this report.

Yield of Corn, Tillage Studies in Western Iowa, 1948

Cooperator	County	Yield Corn Bu/Ac.									
		No Fertilizer					With Fertilizer*				
		Plowed	Loose Ground Listed	Hard Ground Listed	Subsurface Tilled	TNT Plowed	Plowed	Loose Ground Listed	Hard Ground Listed	Subsurface Tilled	TNT Plowed
S. Molgaard	Audubon	77.1	89.5	92.2	80.6	90.4	91.8	98.3	90.0	80.5	89.1
B. Miller	Audubon	97.6	102.6	113.2	109.6	104.4	108.7	111.9	119.8	113.9	98.5
Schroeder Bros.	Carroll	88.8	87.7	88.2	76.8	-	91.7	91.6	84.4	87.4	-
M. Muecke	Plymouth	92.3	89.4	93.3	85.5	-	98.5	97.5	103.4	87.1	-
M. Anderson	Plymouth	83.6	90.7	106.7	82.3	-	90.9	99.6	98.9	93.2	-
C. Miller	Woodbury	69.8	70.3	58.7	56.6	-	79.1	73.3	65.2	68.1	-
C. Beaver	Woodbury	104.0	97.0	107.1	100.0	-	101.1	104.6	113.3	103.6	-
L. Loomis	Monona	44.4	64.3	41.8	47.4	-	51.8	67.2	43.9	58.8	-
West. Ia. Expt. Farm	Monona	70.0	63.0	61.8	53.6	-	76.2	91.2	92.7	73.9	-
K. Johnson	Sac	94.2	93.6	91.4	96.2	Roto Tilled	104.8	101.7	101.5	97.9	Roto Tilled
Rabe Bros.	Sac	123.3 -	105.9 -	103.7 -	127.6 -	109.2** 115.0***	121.4 -	112.0 -	108.8 -	127.1 -	126.4** 128.2***
Ave. bu/A for 11 fields		85.9	86.7	87.1	83.9		92.4	95.4	92.9	90.0	

* Represents 125 lb/A of 4-16-0 with planter attachment plus 100 lb/A 33-0-0 broadcast before planting.
** Represents seedbed prepared by roto-tilling once and the corn hard-ground listed.
*** Represents seedbed prepared by roto-tilling first about 4" and then again at about 6" two weeks later when the corn was surface planted.

Summary of Stand of Corn, Tillage Studies in Western Iowa, 1948

Cooperator	County	Yield Corn Plants/A									
		No Fertilizer					With Fertilizer*				
		Plowed	Loose Ground Listed	Hard Ground Listed	Subsurface Tilled	TNT Plowed	Plowed	Loose Ground Listed	Hard Ground Listed	Subsurface Tilled	TNT Plowed
S. Molgaard	Audubon	9680	9810	11511	9778	10138	10758	10072	10890	10334	9614
B. Miller	Audubon	10236	10857	11674	11217	10824	10726	10530	12100	10628	9582
Schroeder Bros.	Carroll	10170	9876	9353	9058	-	10072	9712	8862	9091	-
M. Muecke	Plymouth	11216	9549	11086	9581	-	11020	10203	10203	9156	-
M. Anderson	Plymouth	8862	8633	11543	8796	-	9581	9222	10922	10039	-
C. Miller	Woodbury	8535	8044	7227	6442	-	8829	7717	7554	8044	-
C. Beaver	Woodbury	11217	11053	11904	11904	-	11021	11380	12852	11773	-
L. Loomis	Monona	7227	7259	4873	6998	-	6802	6965	4120	7423	-
West. Ia. Exptl. Farm	Monona	9636	10595	11642	9647	Roto Tilled	9876	11773	12427	10552	Roto Tilled
K. Johnson	Sac	10039	9811	11216	10203		10399	9778	11413	10039	
Rabe Bros.	Sac	12361	10497	10726	11838	11707**	12001	10693	11347	12394	11740**
		-	-	-	-	12198***	-	-	-	-	13440***
Ave. plants/A for 11 fields		9925	9635	10250	9587		10099	9822	10245	9952	

* Represents 125 lbs/A of 4-16-0 with planter attachment plus 100 lbs/A 33-0-0 broadcast before planting.

** Represents seedbed prepared by roto-tilling once and the corn hard-ground listed.

*** Represents seedbed prepared by roto-tilling first at about 4" and then again at about 6" two weeks later when the corn was surface planted.

Grazing Results from Seeded Dryland Pastures, Archer Field Station - O. K. Barnes, Laramie, Wyoming.-"Table 1 gives the grazing rates and lamb gains for the first six years and for 1948, the seventh year.

"These results indicate that: (1) In dry years these grasses fall in production to a point approaching the native pasture, whereas in average or above average years their production is 2 to 3 times greater than native pastures; (2) Seedings made in widespaced rows (35" apart) have shown only a slight drop below average production during the two dry years we have experienced. In favorable years this spacing has not produced as much as the close-spaced drill rows and consequently the average for the 7 years from the wide-spaced rows is lower than for the drilled seedings; (3) The mixture of crested and alfalfa in 35 inch rows is the most outstanding seeding in this study. In 1948 this pasture carried 30 per cent more sheep than the row seeding of crested wheat alone. This difference is also in line with the 6 year average. In 1948 this crested wheat-alfalfa mixture in 35 inch rows carried nearly double the number of sheep supported on the drilled crested wheat pastures; (4) The Russian wildrye and western wheat grass pastures have consistently supported fewer animals than crested wheat and this was true again in 1948. Both of these pastures are used in the summer and, for that reason, daily gains of the animals run lower than they do on spring grazed pastures; (5) The blue grama-buffalo grass pasture continues to fall in production. As previously pointed out, the buffalo grass has spread at the expense of the blue grama and the grazing capacity and gains have been reduced as this increase took place. The ground cover on the pasture is still high, being equal to good native pasture, although the grazing capacity has fallen below that for native pasture. The lamb gain from this seeded blue grama-buffalo grass pasture fell to less than one-half that on native pasture in 1948.

Table 1.--Grazing results from seeded dryland pastures, Archer Field Station

	6 Yr. Ave. 1942-1947		1948	
	Sheep Days Per Acre	Lamb Gain Per Acre	Sheep Days Per Acre	Lamb Gain Per Acre
Standard crested wheat	165	100	66	53
Fairway crested wheat	161	97	66	46
Grass mixture*	145	83	62	41
Crested wheat-alfalfa (35" rows)	178	105	119	67
Crested wheat (35" rows)	129	67	91	48
Russian wildrye	122	60	53	25
Western wheat	130	71	54	35
Blue grama-buffalo grass	127	41	38	11
Native pasture	63	30	50	26

* Includes: Crested wheat, western wheat, Russian wildrye.

Wheat Production in Relation to Tillage and Cropping Method - Torlief S. Aasheim, Havre, Montana.-"Following is a tabular summary of results obtained from certain tillage practices and cropping methods at the North Montana Branch Station, Havre, Montana, and at a Field Trial near Froid, Montana.

North Montana Branch Station, Havre, Montana, Average of six years 1943 through 1948

Fallow Method		Grain Yield Bushels	Straw Yield Pounds	Test Weight Pounds	Percent Protein	Percent Moisture Per foot
Sub-Surface	T	18.6	2404	56.7	16.0	13.1
" "	B	17.6	2404	56.3	16.0	13.2
Average		18.1	2404	56.5	16.0	13.2
Oneway	T	17.7	2378	56.2	16.4	12.5
	B	18.1	2502	56.7	16.5	12.8
Average		17.9	2440	56.5	16.5	12.7
Mold Board Plow	T	17.4	2398	56.4	16.7	12.2
" " "	B	17.7	2503	56.7	16.7	12.8
Average		17.6	2450	56.6	16.7	12.5

	All Unburned	All Burned
Average yield grain, bushels	17.9	17.8
Average yield straw, pounds	2393	2469
Average test weight, pounds	56.4	56.6
Average percent protein	16.4	16.4
Average percent moisture per foot	12.6	12.9

T - Stubble not burned.
B - Stubble burned.

Averages of various tillage and cropping practices conducted at Froid, Montana, during the years, 1941 through 1947.

Treatment		Bushels Grain Per Acre	Pounds Straw Per acre	Test Weight Per Bu.	Percent Protein	Percent Moisture Per foot
Idle	B	20.7	1882	60.1	12.2	11.5
Idle (Weeds mowed)	T	21.0	2017	59.8	12.6	11.0
Average all idle		20.9	1950	60.0	12.4	11.3
Corn ground		21.5	2081	59.9	12.2	11.1

(Continued)

Methods of Fallow - Alternate Crop and Fallow System

Oneway		27.9	3023	58.9	14.9	13.0
M. Bd. Plow D.F. & W.	B	28.5	3085	59.5	15.0	14.1
M. Bd. Plow D.F. & W.	T	28.9	3186	59.1	15.1	12.9
M. Bd. Plow D.F.	T	29.4	3223	59.3	14.8	12.9
M. Bd. Plow R.W.	T	30.7	3227	58.9	14.9	13.2
M. Bd. Plow B.L.	T	28.3	3222	59.2	14.8	13.3
Ave. all Md. Bd.		29.2	3188	59.2	14.9	13.3
Noble Cultivator	T	27.7	2987	59.5	14.1	13.6
Chase Cultivator	T	29.2	3023	59.4	13.9	13.6
Chase Cultivator	B	28.4	3104	59.1	15.3	13.1
Ave. all Sub-Surface		28.4	3038	59.3	14.4	13.4

Two-Year Crop, One-Year Fallow System

1st crop R-1	T	29.2	3315	58.0	15.1	
1st crop R-2	T	28.8	3432	57.8	15.4	
1st crop R-3	T	28.5	3381	58.0	15.3	
Ave. 1st Year Crop		28.8	3376	57.9	15.3	
2nd crop R-1	T	24.1	2116	59.3	13.6	11.9
2nd crop R-2	B	25.4	2272	58.6	13.9	
2nd crop R-3	T	20.6	2101	59.3	13.7	11.9
Ave. 2nd Year Crop		23.4	2163	59.1	13.7	11.9

Grain and straw yields for 1945 not included due to damage from wind, hail and sawfly.
Soil moisture average of five-foot depths.

B - Stubble burned
T - Stubble not burned
R-1 - Stubble plowed under in the spring in preparation for second year crop after fallow.
R-2 - Stubble burned and then spring plowed in preparation for second year crop after fallow.
R-3 - Stubble sub-surface tilled immediately after harvest and again in spring in preparation for second year crop after fallow.

Correlation of Soil Temperatures with Atmosphere Temperatures Under Stubble Mulch Tillage-Plowing for Wheat - C. L. Englehorn - Fargo, N. D.-"As has been previously indicated the temperature of the surface soil of a stubble-mulch tilled field is generally lower than that of a plowed field. At the very surface, one inch in depth, differences of as much as 18 degrees Fahrenheit have been found. On fall tilled land seeded to wheat the following spring the average difference ranges from about 10 degrees Fahrenheit during the last part of May to 1 or 2 degrees during the first of July.

"A comparison of the degree of correlation of soil temperatures as they were recorded during the season under these types of tillage with atmospheric temperatures during the same period aids in illustrating the reason for the difference in soil temperature. Calculated was the coefficient of correlation of soil temperatures with maximum, minimum and mean atmospheric temperatures. For these data a coefficient of correlation of 0.33 or better is significant at the 5 percent level and of 0.42 or better is significant at the 1 percent level. The coefficients of correlation are included in the following table.

Correlation of soil temperatures as determined at 1, 3.5, 6 and 8 inch depths under stubble mulch tillage with atmospheric temperature at Langdon, 1947

Type of tillage	Coefficient of correlation of temperatures of: 1"	3.5"	6"	8"
	Maximum atmospheric temperatures			
Stubble mulch	.8566	.8622	.8176	.8114
Plow	.7449	.8372	.8180	.8282
	Minimum atmospheric temperature			
Stubble mulch	.7506	.8352	.8819	.8848
Plow	.5320	.7420	.8402	.8841
	Mean atmospheric temperature			
Stubble mulch	.8639	.9132	.9232	.9194
Plow	.6749	.8430	.8912	.9263
	Atmospheric temperature at time of observation			
Stubble mulch	.9149	.8780	.9390	.8029
Plow	.8466	.9044	.8344	.8273

"In all cases the degree of correlation was high, indicating a generally close relationship between air and soil temperature which are significant. At the surface and extending to a depth of 6 inches there is a higher degree of correlation of atmospheric temperature with soil temperatures of stubble mulch tilled land than with soil temperatures of plowed land. This is true not only in the case of maximum daily temperatures but also of minimum, mean, and atmospheric temperatures as of the exact time of reading soil temperatures of soils of stubble mulch tilled land more nearly parallel fluctuations in atmospheric temperature than do those of soils of plowed land. This does not indicate a difference in absorption of heat from the surrounding atmosphere. Rather, absorption of heat from this source is the same whereas the plowed soil receives an additional amount of heat by the absorption of sunlight which on mulch land is reflected away from the soil by the light colored plant residues.

"This is further illustrated by the fact that in the case of stubble mulch tillage a higher degree of correlation of soil temperature with maximum atmospheric temperature is obtained at the surface than at a depth of 8 inches while in the case of plowed soil the opposite is true. Under stubble mulch tillage soil temperatures adjust themselves to changes in

atmospheric temperatures more rapidly at the surface than at greater depth; hence the better correlation at the surface. Doubtless plowed soils will adjust themselves as rapidly to changes in atmospheric temperature, but in this case there is an additional fluctuation due to changes in the amount of sunlight to which they are exposed; hence the lower degreesof correlation at the surface.

"Although at the 8 inch depth the soil temperature is somewhat higher on plowed than on stubble mulch tilled land, these temperatures correlate equally well with the various atmospheric temperatures. Whereas atmospheric temperatures vary widely from day to day they gradually increase with advance in season. At the greater depth soil temperatures fluctuate less rapidly from day to day, but the increase in temperatures with advance of season closely parallels that of the air, though it may lag somewhat."

Response of Cereal Rye Winter Cover Crop to Fertilizers — Maurice Donnelly, Riverside, California.-"The tough annual grass, cereal rye, is planted extensively in the Wind Area of southern California to control soil blowing during winter months in grape vineyards. Its usefulness depends largely on the rate at which it grows in the late fall. The surface soils of the area are largely sands, low in readily available plant food. To determine the response of this protective grass to fertilizers, plot studies were started in the fall of 1947. One year's data are at hand bearing on the response of the grass to fertilizer and on the indirect effect of strong growth of the grass cover crop on the succeeding grape crop. These data are summarized in the table below. Nitrogen was applied as ammonium sulphate; phosphorus as treble superphosphate.

Fertilizer	Dry weight of grass tops Lbs. per acre	Weight of wind grapes Tons per acre
Check (None)	152	3.57
Nitrogen only - 36 lbs. nitrogen per acre	468	3.21
Phosphorus only 75 lbs. P_2O_5 per acre	110	4.02
Nitrogen and phosphorus 36 lbs. nitrogen per acre 75 lbs. P_2O_5 per acre	895	4.23

"Some of the trends to be noted in the data are:

1. The grass did not respond at all to applications of phosphorus alone.
2. The grass responded (2) moderately to applications of nitrogen alone and (b) strongly to applications of phosphorus and nitrogen.
3. There was depression of grape yields, on these plots for the season 1948, as a result of strong growth of cereal rye grass as winter cover crop.

"A point of economic concern should be borne in mind in connection with the phosphorus applications. Judged by the findings of Wohletz and associates, it would not be necessary to supply this large amount of phosphorus (75 lbs. of P_2O_5) year after year in order to obtain the desired response. The initial heavy application according to Wohletz, is needed to make p phosphorus available over and above that fixed in the soil. Once the fixing power has been satisfied, succeeding applications could be at a much lighter rate."

Effect of Different Methods of Tillage, Direction of Cultivation and Terraces on the Percentage of Runoff at Cherokee, Oklahoma, 1948 - Harley A. Daniel, Guthrie, Oklahoma.-

	Direction of Cultivation and Terraces							
	With Slope		Contour		Terrace-Contour		Average	
	Big Rains 1/	Annual	Big Rains 1/	Annual	Big Rains 1/	Annual	Big Rains 1/	Annual
Stubble Mulch	24.97	9.22	25.36	9.17	18.44	6.73	22.92	8.37
Plowed	35.45	13.76	25.95	9.96	21.34	7.97	27.58	10.56
Listed	32.20	12.03	25.05	9.44	23.43	8.26	26.89	9.91
Basin Listed	33.19	12.81	25.44	8.91	27.23	9.68	28.62	10.41
Average	31.45	11.95	25.45	9.37	22.61	8.16	26.50	9.83

1/ Big rains, average of two (2/26/48 and 6/27/48) that caused runoff from all plots.

"More water was conserved on the stubble mulch plots than on those tilled by plowing, listing or basin listing. But most of the runoff occurred during the spring growing season at a time when listing and basin listing were least effective. The amount of runoff water was greatly reduced, however, by contour cultivation and terracing."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Frost in wheatland reached a depth of 6 inches and only 1 inch in grassland. The following table shows that the wheatland soil was frozen on 19 days of the month and for 13 days on grassland.

Table 1.--Depth of frost penetration on wheat and meadow watersheds in December 1948

Depth of frost penetration (inches)	Number of days frost in: Wheat	Meadow
<1	3	10
1	3	3
2	2	
3	6	
4	2	
5	1	
6	2	
Total	19	13

"Maximum air and soil temperatures for the period April through December are given in table 2 for meadow and woodland. Comparisons may be made of soil and canopy temperatures in these two land-use areas.

Table 2.--Maximum temperatures (°F) in the canopy and soil at various depths for monthly intervals on meadow and woodland watersheds

Date 1948	Watershed 109 (meadow) Height above ground: 30"	2"	Depth in soil: 1/2"	3"	6"	24"	Watershed 131 (woods) Height above ground: 30"	2"	Depth in soil: 1/2"	3"	6"	24"
4-30	63	70	55	56	59	53	-	66	58	54	58	56
5-31	66	74	64	58	61	56	-	60	58	58	62	60
6-30	80	87	70	72	70	65	-	66	66	64	70	66
7-31	81	90	73	73	71	67	-	68	70	66	74	70
8-31	74	87	74	73	72	70	73	72	68	66	74	70
9-30	72	77	60	64	62	61	65	63	64	60	68	70
10-31	53	52	46	50	54	52	51	50	54	54	61	63
11-30	47	50	34	40	42	45	40	46	48	46	53	57
12-31	34	34	27	30	36	36	22	25	38	38	45	50

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"About 10 inches of snow fell in December, which amounted to 0.40 inch of moisture at the Meteorological Station. High winds accompanied most of the snow storms, except on December 24, when a 5-inch snow blanketed the ground and settled in place, thus providing moisture and some protection from later blowing in the open fields. This moisture will especially benefit the wheat.

"Runoff computations for the growing season of 1948 was in progress. The following tables show the total runoff and peak rates on the 4-acre corn watersheds farmed by different land-use practices.

Runoff and Peak Rates
Corn Watersheds - April 1-Sept. 30, 1948
Total runoff in inches

1948	Rainfall at Met.Sta.	Straight row			Contoured			Subtilled			
		6H	15H	Ave.	7H-	9H	Ave.	10H	20H	23H	Ave.
May 3	0.82	T	0	T	T	0	T	0	0	0	0
May 30	.64	0	0	0	T	0	T	0	0	0	0
June 21	.77	.06	.05	.05	T	T	T	.01	.14	.02	.06
June 26	1.10	.27	.33	.30	.09	.09	.09	.12	.36	.38	.29
July 9	1.71	.23	.47	.35	.04	.04	.04	.03	.12	.25	.13
July 18	.93	.57	.67	.62	.25	.36	.31	.03	.09	.63	.25
July 28	.79	.10	.16	.13	.01	.04	.03	T	.08	.08	.05
Aug. 15	.38	0	.01	T	T	T	T	0	.01	T	T
		1.23	1.68	1.46	.41	.53	.47	.19	.80	1.36	.78

Peak Rates of Runoff - Inches Per Hour

1948	Max. 5 min. intensity Met.Sta.+	Straight row 6H	Straight row 15H	Straight row Ave.	Contoured 7H	Contoured 9H	Contoured Ave.	Subtilled 10H	Subtilled 20H	Subtilled 23H	Subtilled Ave.
May 3		T	0	T	T	0	T	0	0	0	0
May 30		0	0	0	T	0	T	0	0	0	0
June 21	3.36	.34	.29	.32	T	.01	.01	.06	.50	.09	.22
June 26	2.40	1.03	1.24	1.14	.54	.48	.51	.37	1.00	1.22	.86
July 9	3.12	.55	.92	.73	.10	.09	.94	.09	.33	.57	.33
July 18	6.00	2.57	4.00	3.28	1.27	2.27	1.77	.10	.33	3.08	1.17
July 28	2.88	.38	.56	.47	.08	.16	.12	T	.33	.56	.30
Aug. 15		0	.07	.04	T	.01	.01	0	.06	.01	.02
Ave. Peak Rate - 5 storms June-July 1948				1.18			.67				.58

Total rainfall for period at Met. Station+ April 0.58; May 1.80; June, 4.25; July 4.18; Aug. 0.91; Sept. 1.09.

+Recording rain gages nearest area will be used in computing actual rainfall.

"A short article entitled 'Moisture in the Ground - Corn in the Crib' by John A. Allis was cleared through the Nebraska State Experiment Station after reviewing by Dr. Duley. This article was submitted to Washington on December 21, 1948 and it is hoped that it will be published in the 'Soil Conservation' magazine. Three pictures which accompany the article show the actual yield of 3-1/2 cribs of corn from a 4-acre, straight row watershed; 4-1/2 cribs from a contoured, and almost 5 cribs from the subtilled watershed. The increased yields were due to the conservation of moisture during June and July on the subtilled and contoured areas, which are represented in the above tables."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"A heavy rain of December 28 and 29 produced runoff from several of the experimental watersheds. A rain of 1.23 inches at the Throckmorton Farm produced about 0.4 inch of runoff from wheat watersheds under the prevailing treatment and approximately 1/10 of that amount from the wheat watersheds under

the conservation treatment. The prevailing treated watersheds in new meadow averaged about 0.2 inch of runoff; and those under the conservation treatment, 0.04 inch (same as wheat conservation treated). There was no significant runoff from the old meadows."

Hydrologic Studies - George A. Crabb, Jr.-"Precipitation for the month of December as measured by the USWB type of non-recording rain gages amounted to 2.23 inches at the cultivated watershed, 2.32 inches at the wooded watershed, and 2.26 inches at the stubble mulch plots. These amounts are approximately 108 percent, 112 percent, and 108 percent of the 2.07 inches normal for East Lansing. There were two measurable snowfalls during the month of 1-1/2 inches on December 20 and 4 inches on December 30.

"There was one runoff from watershed 'A' on December 28 of 0.4093 inch and one from watershed 'B' of 0.0152 inch on December 16 and one from watershed 'B' of 0.4707 inch on December 28. These runoffs were occasioned on the 16th by rain on frozen soil and on the 28th by rain and snow melt. Soil losses were minor and are still being computed. December continued mild with two occasions of zero and sub-zero temperatures.

"In line with this project's policy of reporting new developments in related fields of research, a brief, preliminary report of the development of a new type of unit for determining soil moisture by electrical resistance is incorporated herewith. This unit has been devised by Dr. George J. Bouyoucos, Department of Soil Science, Michigan Agricultural Experiment Station, who developed the plaster of paris and fiber-glass units now in general use. It is felt that this new unit will have wide applicability to problems on our various research projects over the country.

"Dr. Bouyoucos reports that the new unit acts, in general, on the same principle as the plaster of paris and fiber-glass units that have proved successful in the past. The primary difference is that the elements of this block are separated and encased in nylon fabric. This nylon possesses the very special characteristic of more readily absorbing and releasing soil moisture to the level of the surrounding soil. This causes it to stay in more constant equilibrium with the moisture content of the soil. The nylon does not react chemically with the soil, nor does it absorb salts to any extent. It's lack of buffering action is compensated for in calibration at the time of installation. It will be remembered that fiber-glass did not possess this quality of chemical stability. In addition to these characteristics, the nylon unit has an anticipated longer life than either the plaster of paris or fiber-glass units. Another feature of the new unit is its great sensitivity to moisture changes at high moisture level contents. This advantage is particularly noted in comparison with the fiber-glass unit. In this feature, the nylon unit is definitely superior to all other units yet studied. It functions over a range of moisture content from saturation to almost air-dryness.

"The new unit is in production by the Wood and Metal Products Co., Bloomfield Hills, Michigan, at a cost of $2.00 each. Dr. Bouyoucos also reports that a much more highly refined model of the specially modified Wheatstone bridge, used with these blocks to measure their resistance, is available from the same source at $165.00 each. The project supervisor has personally examined both of these items, in the finished product, and they appear to be very competently made."

Hydrologic Studies - R. W. Baird, Waco, Texas.-"Rainfall for the month of December totaled 1.43 inches. This moisture fell at a critical time for our winter cover crops and moisture conditions now are such that unless severe cold strikes soon we will probably be able to carry our winter crops through the winter season. Total rainfall for 1948 was 24.37 inches and for 1947, 25.03 inches. The normal rainfall at Waco is about 35 inches. Since the early summer of 1947 there has been a deficiency of about 20 inches of rainfall. This shows up as an absolute lack of soil moisture except in the surface soil, and no ground-water flow in any streams in the area."

Hydrologic Studies - E. H. Kidder, Auburn, Alabama.-"The November rainfall of 15.98 inches was 512 percent of the 40-year average of 3.12 inches reported for Auburn in the USDA Yearbook, 'Climate and Man.'

"The December rainfall of 3.08 inches is 0.63 inch less than the 6-year average for our North Auburn gage. It is 57 percent of the 40-year average of 5.40 inches.

"Slightly over half of the November precipitation fell on November 26, 27, and 28. The rainfall on November 26 was 6.70 inches at Pond No. 4 and 6.82 inches at the Duncan Pond.

"This amount of precipitation, which occurred in 16 hours, would classify this storm as a once in 25-year frequency (Yarnell, Rainfall Intensity-Frequency Data). The antecedent rainfall prior to the 25-year frequency storm was 3.47 inches that fell between November 21 and November 24.

"Of the 8.34 inches of precipitation that fell on the watershed of Pond No. 4 between November 26 and November 29, 79 percent ran off through the spillway of the pond. The precipitation at the Duncan Pond during the same period was 8.05 inches, 72 percent of this rainfall being discharged through the pond spillway. The runoff for the month of November from Pond No. 4 was 54 percent of the rainfall; while the runoff from the Duncan Pond was 45 percent of the rainfall.

"Pond No. 4 is located on a Lower Coastal Plains soil that is classified as Chesterfield sandy loam (deep phase). The Duncan Pond is situated on Piedmont Plateau soil that is classified as Madison sandy loam (eroded phase). Most of the watershed of Pond No. 4 is in terraced cultivated

orchard; while the watershed of the Duncan Pond has about the upper 50 percent covered with kudzu and the lower 50 percent covered with a good stand of pine.

"Apparently the bulk of the runoff from Pond No. 4 occurs as subsurface flow, since runoff continues for several days after the end of a period of rainfall. On the Duncan Pond, runoff ceases within a short time after the end of the rainfall.

Table 1.--Runoff from fish ponds

	Rainfall Inches	Rainfall Acre-inches	Runoff Acre-inches	Runoff Percent of Rainfall
Pond No. 4				
November	17.21	425.78	231.70	54.4
Nov. 26-30	8.34	206.33	163.18	79.0
Duncan Pond				
November	16.70	300.60	135.75	45.1
Nov. 26-Dec. 2	8.05	144.90	104.03	71.8

Hydrologic Studies. - T. W. Edminster, Blacksburg, Virginia.-"On December 2 and 3, the Project Supervisor, together with Mr. J. R. Price, Agricultural Aide, dismantled the gaging equipment on the three Chatham watersheds. Each stilling well was equipped with a conical aluminum roof and an inside staff gage installed to record high water marks through the use of floating cork. One recording rain gage, one standard rain gage and the hygrothermograph were reinstalled two miles north of Chatham on the farm of Mr. Sam Owens, Conservation Aide. An amendment to the work plan covering the watershed is now in preparation.

"On December 8 the Project Supervisor presented a review of his work as a member of the Research Advisory Committee of the Water Resources Committee on the Virginia Economy to members of the State Soil Conservation Committee at their regular meeting. This report emphasized the importance of having the thorough support of the Soil Conservation groups in protecting water resources for agricultural use."

Runoff Studies - N. E. Minshall, Madison, Wisconsin.-"Precipitation at Edwardsville for December was 1.55 inches, as compared to a normal of 2.2 inches. Most of this precipitation was in the form of rain or sleet and there was little surface runoff. Temperatures varied from a maximum of 74 degrees on the 15th to a minimum of 10 degrees on the 26th with a mean of 34 degrees, or nearly normal.

"Precipitation at Fennimore for December was 1.36 inches compared with a normal of 1.2 inches. Most of this was either rain or sleet, and there was no appreciable surface runoff."

Farm Ponds - T. W. Edminster, Blacksburg, Virginia.-"Mr. Holtan reports that five soils were treated with bentonite to find the lowest amount needed to seal versus 30' head of water. Supplementing this with compaction of 50#/sq.in. load, bentonite needed ranged from 3/4 of a pound to 1-1/2#/sq.ft. of surface. After the successful treatment was determined with the compaction supplement, the sample was removed and puddled to see if puddling were as effective as 50#/sq.in. compaction. In three out of five instances, puddling was as effective but in the other two, more bentonite had to be added to seal the puddled soil.

"Sedimentation curves of effective particle size on the 12 soils are on hand but no readily discernible association was found between the type of curve and such criterion as compaction needed for sealing or length of column needed for sealing. It is hoped that these can be closely studied later on.

"Sedimentation curves of the bentonite treated soil indicated one of the five had greater aggregation due to bentonite; three of the five had greater clay after treatment, and one had practically the same sedimentation curve as the untreated soil."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minn.-"With minor exceptions the entire staff spent the month of December on model tests for the Whiting Naval Air Station drainage system.

"Some time was spent on the preparation of a report covering the tests of a drop structure designated B-6, but the report is still far from complete. Pressure of other work has delayed the submission of the report.

"Mr. Bowers tested four different designs for the junction of C-ditch and the Owens Court lateral, designated C-4. Descriptions of the models and tests follow. Flow in C-ditch is at supercritical velocities and in the Owens Court lateral is at subcritical velocities.

"The use of vertical side walls alone in the vicinity of the junction reduces surface disturbances downstream from the junction but not as economically or as much as do other methods.

"The use of a pier extending obliquely from the side of the main channel upstream of the junction to create a counter disturbance plus a short vertical side wall along the main channel opposite the lateral produces equal or better results more economically. However, it appears that the rate of runoff curves at this junction may be far from synchronized. In order that the disturbance created by the lateral may be cancelled by the counter disturbance created by the pier, this design requires flows in both main and lateral channels. This design is, therefore, not adaptable to this junction.

"A single submerged pier downstream from the junction plus a short section of vertical side wall along the main channel opposite the lateral gave results about equal to those obtained with a counter disturbance. The pier had to be long to cover the complete range of flows. This latter design was selected for further study after a conference with Mr. Moratz of the Milwaukee, Wisconsin, Regional Office.

"Variations in the location, number and size of the piers were studied. Best results were obtained with two staggered piers 2.4 feet maximum height and 58 feet long. The surface disturbances downstream from these piers was nil for all flows and all combinations of flows. Since this design is easy to construct and economical, it appears now that the final recommendation will be for a junction design incorporating straightening piers. Additional work on this design and tests of at least two other junction designs will be made before terminating the studies on this junction.

"Work was begun after Christmas on ditch outlet structure C-5. About 595 cfs approaches the end of this ditch at velocities of 40 ft. per sec. We are attempting to develop a deflector to spray this water onto the delta and let the stream dig its own stilling basin. Work has not yet progressed sufficiently to report results on this study.

"The pipe outlet structure at P-1 was modeled early in the month. No work has been done on this structure since December 14 because the location of one of the pipe outlets will have to be changed and the necessary information has not yet been received from Whiting Field.

"On December 9 Mr. Blaisdell accompanied Mr. Parsons to Owen, Wisconsin, to look at silt sampling wheel installations. On the way back they stopped at Menomonie, Wisc., to inspect soil conservation structures in that vicinity. At one location two chute spillways were inspected. The

upper spillway has no energy dissipator while the lower, draining a larger area, has an energy dissipator patterned after some early tests made at the St. Anthony Falls Hydraulic Laboratory. Both spillways passed design floods in 1942 and the scour below each spillway appeared satisfactory afterwards. At present the upper structure, with no outlet, has a hole about 3 feet deep below it while the lower structure, with a good outlet, has no recognizable scour hole. At another location the need for regular inspection and timely maintenance was brought out. Here a cantilevered pipe outlet structure has failed, apparently because the dam fill was raw from overpasturing, permitting scour to undermine the pipe, and because inexpensive repairs, which were obviously needed in 1942, had not been made in 1948.

"Initial steps were taken late in the month toward the preparation of a report of the pipe drop inlet spillway tests completed to date.

"On December 31 Professor R. K. Frevert again visited the project to discuss rate measuring and silt sampling installations at the flood control structures built in the Little Sioux watershed in northwestern Iowa. Mr. Moratz of the Regional Engineering Division spent December 20 at the project going over the results obtained from the Whiting Naval Air Station studies."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"Computations were completed on the experiment on split beard bluestem, Andropogon ternarius. Split beard bluestem is quite prevalent throughout this area. It is one of the grasses that will come into abandoned fields following the annual three awn stage. Observation in the field indicated that it might be a good vegetation for erosion control. It seems to establish readily in the less fertile soils and gives a fair cover. Plenty of seed is available. It is not considered a good forage grass so it has not received much attention. However, since it showed possibility as a waterway lining it is being investigated at the laboratory.

"The split beard bluestem was planted in one of the unit channels in 1947. This channel is 3 feet wide, 100 feet long and on a 5 percent slope. The sides of the channel were vertical plywood walls which were erected shortly before the tests. The channel was tested in October 1948. At this time the grass averaged 8 inches in length with a density of about 320 stems per square foot. The cover consisted of small clumps closely spaced.

"Testing showed some slight scour taking place between the clumps at a mean velocity of 2.5 feet per second. However, no serious damage occurred at higher velocities. It is believed that for short duration flows the permissible velocity for this cover on an erosion resistant (low detachability) soil is 4 feet per second. The retardance of this cover was between that of a class B and a class C."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"This has been another month of low rainfall, though as will be noted from the following table, our rainfall for the past 2 years at our various stations is about the same as for this month.

Location-Gage	December 1948	December 1947	December 1946
Redland & Mowry	1.00	1.57	1.54
Sub-Trop. Expt. Sta.	.46	1.45	2.05
Redland & Gossman	.67	.79	3.01
Plummer & Comfort	.85	---	---
Peters, Fla.	2.32	1.90	2.37
Princeton, Fla.	1.60	1.57	1.34
Cooper	1.05	.64	1.43
West Mowry	1.27	1.44	1.89
E-33	1.65	1.15	1.60
Roberts & Avocado	1.00	1.98	1.55
Jeran Grove	2.30	---	---

"Losses in our water table for the month for the Redland profile varied from 0.29 foot at Highlands plot to 0.86 foot at Well #10 which is 2-1/2 miles north of the Experiment Station. Losses for the same period a year ago were much higher when losses of 0.81 foot at Highlands and 1.37 feet one-half mile north of the Experiment Station were recorded.

"For the Mowry Street profile the loss in water table ranged from a slight gain at E-32 (East Glades) to 0.93 at Well #26 at the west end of the profile. Losses during the same period a year ago were much greater with 0.52 foot at E-32 to 1.21 feet at Well #26.

"For the Eureka profile the losses ranged from 0.85 foot at the western end of the profile to 1.06 feet at Well #25 east of Peters. For the same period a year ago losses ranged from 1.08 feet to 1.33 feet.

"From the above it will be noted that even though our rainfall is less than a year ago, our loss in water table has been less than that of a year ago. Our data indicate that we have two factors which are helping to stabilize our water table. The water table in the back country is high, and we have our coastal controls in operation. I believe these coastal controls have had a definite effect in controlling the outflow of water in our canals and have helped to hold a higher water table in the marl and rockland area.

"During this period of low rainfall our readings show that there is very little difference in the readings for the pine straw, grass or shavings mulched areas. On the natural cover area we had since the initiation of the work, a slight accumulation of plant residue which at present is giving a slight mulching effect. Our data show that from the standpoint of moisture conservation it is much better to have a cover of grasses than clean cultivation. In conjunction with this study we collected samples which are analyzed for nitrates at sampling, and later will have pH's run on them, also phosphorus and potash. Analysis of samples for nitrates shows that in the grass mulched plot we are getting a breakdown of the grasses and at times this plot has gone to 40 p.p.m. of nitrate nitrogen. The pine straw plot has been much lower and it is thought that this is due not only to the more resistant type of material, but also the bacterial activity may not be as good in this area. We find no accumulation of nitrates in the shavings plot. This of course can be expected from that type of material. Nitrate accumulation for the natural cover plot has been low as most of the natural release is utilized in the growth of new plants."

Drainage Studies - T. W. Edminster, Blacksburg, Va.-"As indicated previously, several 'draw-down' have been noted in the studies on tile stabilization and sedimentation in soils of the Moyock series. The Drainage Engineer opened the tile laterals in two places for observation. The first place, Lateral 4 (tile placed on boards) was caused by broken tile joint. No definite cause for the breakage was found. The best that could be judged indicated that the pipe for probe tube located over the joint had been disturbed, breaking the tile in the process. The second observation was made in Lateral 6 about 100 feet below the sawdust binding study area. In this case top soil could be traced from ground surface to tile. Tile joints were fitting together poorly, however, with the inferior grade of tile used for the study, it is impossible to determine the possibility of tile movement. The asphalt-treated roofing paper used to cover the tile was decayed making its value questionable."

Supplemental Irrigation Studies - James Turnbull, Lake Alfred, Fla.-"Tests made on our irrigation plots at Lake Alfred show that irrigation affects the internal quality of citrus as well as the size and the quantity of fruit produced. The quantity of juice per fruit is increased by irrigation but the quality of the juice is lowered."

IRRIGATION DIVISION

Rainfall Penetration, Upper Santa Ana Valley, Calif. - Dean C. Muckel, Pomona, Calif.-"The relationship between rainfall penetration below the root zone and annual precipitation was calculated for 19 irrigated and non-irrigated crops in Chino Basin. Rainfall penetration for those crops had previously been determined for each individual year from 1927-28 to 1946-47, inclusive, but had not been correlated with annual precipitation. Rainfall penetration in this case is the water resulting from rains on the valley floor which are in excess of winter evapotranspiration, fall soil moisture deficiency and runoff. In Chino Basin, it constitutes a substantial contribution to the ground water supplies, which are drawn on heavily by pumping for irrigation and other uses. The following tabulation shows estimates of the amount of annual rainfall penetration for various crops:

Seasonal rainfall, inches	Estimated annual rainfall penetration below root zone, inches 1/					
	Irrigated			Non-irrigated		
	Citrus	Walnuts	Alfalfa	Hay and grain	Volunteer grass	Brush
9	0	0	0	0	0	0
12	0	0	0.6	0.8	0	0
15	2.0	0	3.1	2.1	1.4	0
18	4.0	0.5	5.5	4.0	4.0	0
21	6.0	3.0	8.0	5.9	6.5	1.4
24	8.1	5.4	10.4	7.9	8.9	4.3
27	10.2	7.7	12.8	9.8	11.4	7.0
30	12.3	10.1	15.3	11.8	14.0	9.9
33	14.3	12.5	17.7	13.6	16.4	12.8

1/ Upper Santa Ana Valley, California."

Imperial Valley Investigation, Calif. - George B. Bradshaw, Imperial, Calif.-"A series of twenty-foot soil samples are being taken on the Imperial Irrigation District's East Mesa Experimental Farm. The soil studies are being made on virgin desert soil that has been wet down and allowed to drain for three days. It was necessary to wet the soil before sampling to prevent sloughing. To date three 20-foot soil samples have been taken at different locations on the 560-acre farm.

"The soils were found to be fairly uniform in both texture and analysis to a depth of twenty feet.

"The following data are for the sample located in units 9 and 13, and is a mean for the 20 feet.

Sieve Analysis - Percentage Retained on Each Sieve

#20	#30	#50	#100	#150	#200	Pan
5.31	6.45	6.33	56.51	18.75	3.31	3.34

"Bouyoucos samples were also run and the mean silt plus clay was 5.92 percent. The difference between the percent in the pan and the percent by the bouyoucos is attributed to the small hard clay nodules that were not broken down fine enough to reach the pan during sieving.

"Field moisture samples were taken and used to supplement laboratory samples run by V. S. Aronovici at Pomona, California."

San Fernando Valley, Calif. - William W. Donnan, Los Angeles, Calif.- "Several days were spent securing in-place soil samples from the various fall deficiency sampling stations. About 40 samples were secured with the Uhland soil sampling unit and with a sampler developed in the Pomona laboratory. From these samples, data will be secured on transmission rates, volume weights and mechanical analysis."

G. Marvin Litz, Los Angeles, Calif.-"Considerable time was spent preparing two maps of the high water table area in the San Fernando Valley Soil Conservation District. The data were taken from the records of the piezometer well grid system. One map was drawn for January 2, 1947, the date of highest water table in the shallow wells. The other map was drawn for October 5, 1948, the date of the lowest water table during the summer and fall of 1948. During this time interval of 22 months there has been no appreciable amount of rainfall. The total precipitation for this period aggregates about 11 inches or 35 percent of normal. The maps show, by contour lines, the depths from the ground surface to the ground water level. A comparison of the two indicates that leakage from known artesian wells and high pressure water mains has maintained a high water table in parts of this area. There has been little, if any, recession in water tables in these areas even though the period has been excessively dry."

Consumptive Use in Colorado - Harry F. Blaney, Los Angeles, Calif.-"Compilation of irrigation and consumptive use of water data for the South Platte Basin and Arkansas Valley were completed in cooperation with the Colorado Water Conservation Board. Tentative computed rates of use, based on irrigation and climatological data, are shown in the following tabulation:

Location	Consumptive use, depth in inches				
	Alfalfa	Grass hay and pasture	Small grain and beans	Other annuals	Orchard
South Platte Basin, Colo.					
Water District 1	27.3	24.1	10.9	15.3	20.2
" " 2	27.3	24.1	10.8	15.3	20.8
" " 3	24.1	21.3	10.4	14.8	19.8
" " 4 and 5	26.2	23.1	10.2	14.6	18.0
" " 6 " 7	24.5	21.6	10.5	15.0	21.6
" " 8	27.3	24.1	10.7	15.3	20.8
Arkansas Valley, Colo.					
Water District 14	29.5	26.0	9.5	20.3	----
" " 67	31.4	27.7	10.2	21.6	----

Spreading Water for Storage Underground - A. T. Mitchelson, D. C. Muckel, H. K. Rouse, E. Bliss, Curtis Johnson.-A regular monthly meeting was held by the group at Bakersfield December 6-8 in order to formulate a program of execution of both field and laboratory activities. All essential equipment and supplies have now been procured and stored, adjusted and made ready for future laboratory work. Actual laboratory work on field samples was started toward the latter part of the month. Samples of soil from two dry experimental ponds were plated for total counts. Samples of water from two operating ponds were also plated along with a sample from the water supply. These samples are in process of incubation and counts have not yet been made.

Operation of the Buffer Pond experiment at the Wasco Spreading Area was continued throughout the month. At the beginning, the inner pond only was being supplied with water to determine what effect, if any, would be noted if the outer pond was permitted to go dry. The outer pond was permitted to dry up beginning on October 19. The rate of percolation in the inner pond continued to drop at a rapid rate at first. Then the rate became less rapid until about November 5. Through the remainder of November and the first 10 days of December, the rate fluctuated moderately but with an overall downward trend. The rate at the time the outer pond was permitted to dry up was 2.85 feet per day. The average rate for the period November 5 to 9 was 1.42 feet per day. Successive mean rates for 5-day periods were 1.38, 1.45, 1.49, 1.49, 1.37, and 1.32 for the 5-day period ending on December 9.

On December 10 water was turned back in the outer pond and kept at the same level as in the inner pond. The rate in the inner pond showed an immediate response and has resumed a steady and moderately rapid decline since. The rates of percolation for successive five-day periods are as follows:

Dec. 10 to 14	.....	1.26 ft. per day
15 to 19	.....	1.14 " " "
20 to 24	.....	1.09 " " "
25 to 29	.....	0.97 " " "
Dec. 30	.....	0.90 " " "
Dec. 31	.....	0.86 " " "

The North Kern Water Storage District has recently completed the ditching and side gate structures for several hundred more acres of spreading area near the Minter Field test ponds. Contour checks are now being constructed.

A report from the Bureau of Reclamation carries the information that the Kaweah Delta Water Storage District has decided to prepare at once two 5-acre adjacent plots of land selected by the Division as experimental areas for water spreading in order to carry out, on a larger scale, the experiments we have been running on the small ponds at Minter Field and Wasco. On one of these plots cotton ball hulls will be disked in while the adjacent plot will be operated without addition of foreign material, as a check.

General Formula for Flow in Pipes - Fred C. Scobey.-There has been added to the mass of United States data now available and prepared for digestion in development of a basic formula for capacity of new commercially smooth pipes of all kinds, the results of Swiss and Italian observations on comparable pipes. There has also been added the data produced by the tests on the recently completed San Diego Aqueduct. The San Diego Aqueduct tests were conducted by a field party under the personal direction of Scobey on several sizes of some 20 individual pipes of great length, at a range of velocities of from 2 feet to nearly 10 feet per second. These tests on 48, 54, 72, and 96 inch pipe indicate capacities slightly higher than our general formula, which is expected since the pipes were all new when the tests were made. It is intended to get a set of check observations during March 1949 for a well established run of water at maximum capacity of the line, about 100 second-feet, to equate against similar runs made in December 1947. Our new formula conforms to a remarkable degree with a wide range of sizes, say, from 4 inches to 18 feet in diameter and with velocities from 1 to 50 feet per second.

Irrigation Practices and Consumptive Use of Water - Paul A. Ewing.-The report on "Irrigation Practices and Consumptive Use of Water in Pajaro Valley," prepared by Messrs. Blaney and Ewing, was completed and submitted. The State Engineer has accepted the report with complimentary acknowledgment.

Friction Losses in Pipes and Fittings. - Carl Rohwer.-Computation of the friction losses through 4, 6, and 8-inch standard swing-check valves was completed and work was started on the computation of the losses through 6, 8, 10 and 12-inch Dempster check valves. These tests show that the losses do not increase uniformly as the discharge increases, but they may decrease slightly with increased flow as the check valve opens. Tests reported elsewhere show similar decreases.

Well Screen Performance Tests.-The bins for storing the special gravel for the gravel envelope tests were completed and the 1, 1/2, and 1/4-inch gravel was received and stored in the bins. Because it was impossible to get travel of the exact sizes required for the tests, it will be necessary to re-screen all the gravel.

Tests were completed on a #40 Johnson screen when all the perforations were closed with a rubber band except the bottom portion of the screen. These tests were made on the screen when all but 6 inches and all but 3 inches were covered. Under these conditions, flow occurred through all the open perforations and not just through the bottom portion as when the 24-inch lengths of perforation were all open. For the 3 and 6-inch sections the losses follow the same pattern as those for the screens with punched perforations. When reduced to equivalent flow per foot of perforated screen, however, they are not quite the same. This may be due to the fact that any trash in the water which catches on the screen obstructs a relatively larger proportion of the area of the perforations. Since it is impossible to keep the water free of all trash, it is doubtful whether it will ever be possible to get perfect agreement in the results.

Ivan D. Wood, Denver, Colo.-December 2nd, Wenatchee, Washington. Meeting of the Soil Conservation District Boards and other state and government officials. Presented a general discussion on irrigation subjects with particular attention to water distribution. Attention was also given to the need for development of a general educational program on irrigation for the State of Washington and closer cooperation between all agencies concerned.

December 3rd, Yakima, Washington. Meeting similar to the one mentioned above but with more interest and larger attendance. A number of extemporaneous talks by influential farmers stressed the need for a change in policy on major irrigation developments. It was the general

consensus of opinion of those present that more development work on the farm units must be done before settlers are put on the land. It was strongly recommended that attention to this point be given on the Columbia Basin Project. The material which I presented was the same as the meeting on December 2nd.

December 4th, Yakima, Washington. Was principal speaker at a meeting of the Yakima Bar Association. An opportunity was presented to give the Bar Association a picture of the irrigation problems in Washington and to stress the need for better cooperation between agencies and the development of a comprehensive educational program for the State. In this meeting, which lasted about 2-1/2 hours, much interest was evidenced by those in attendance and lively discussions took place.

December 6th, Prosser, Washington. An inter-agency meeting was held at this point for the purpose of planning future educational activities for the State of Washington. This was an all-day meeting and was attended by 18 members of the Extension Service, Soil Conservation Service, Bureau of Reclamation as well as personnel from the Washington State College. I acted as discussion leader and believe that this meeting points the way not only to better cooperation in this state between various agencies but to a better educational program. Pending the approval of higher authority it was decided to hold a 3 or 4-day inter-agency school in the summer of 1949 - this to be followed by other activities, plans for which will be formulated later.

Sprinkler Irrigation Studies - W. D. Criddle, Boise, Idaho.-Sprinkler irrigation work this month included assistance to operations in the Caldwell Area, assistance to local dealers in sprinkler equipment and working out details of the project Work Plan to meet the suggestions made by the U. S. Bureau of Reclamation.

Two calls for instruction in the design of sprinkler systems were received from local dealers who have recently added sprinkling equipment to their line of irrigation supplies.

Assistance to the Caldwell Soil Conservation District Office was given in the methods of design of orchard sprinkling systems and the design of a system to be used on a farm having a planned crop rotation of eight years in grain, pasture and alfalfa. A comparison between leveling and the cost of installing a sprinkler system on this farm is being made.

Mr. Criddle and Mr. Pair attended a meeting with representatives of the U. S. Bureau of Reclamation to discuss the project work plan. An improvement in the economical problem in the plan to get that information as soon as possible was suggested by the Project plans sections of the Bureau. All other phases of the plan met with their approval. Mr. Karl Lee was appointed to the Advisory Committee of the project to represent the Project Planning Division of the Bureau of Reclamation.

Silt Studies - Dean W. Bloodgood, Austin, Texas.-Not much to report on silt studies for December on account of the suspension of activities in the silt laboratory during the holiday season from December 15 to January 3. In order to cooperate with the postal authorities during the holiday season in the congestion of mail, we have followed the usual custom of requesting our field men to withhold the mailing of water samples until after the rush is over or has subsided. Texas streams continue to remain dry or at very low water stage, and if it does not rain soon, we might as well "close up shop" as far as silt is concerned. Most of the water samples received at the laboratory do not contain any silt.

During the month I inspected our silt work at the San Saba station on the Colorado River, the Llano station on the Llano River, and Buchanan and Inks Dam on the Colorado River. The river discharge at San Saba and Llano is far below normal and the waters are clear - no silt. The Buchanan and Inks reservoirs contain considerable water but none is being released at either of them - consequently, no silt is being by-passed. Marshall Ford reservoir, located below the Buchanan and Inks Dam, is practically empty (has a storage capacity of about 2,000,000 acre-feet).

Irrigation Studies.-On December 7 I visited the plantation of Johnie Barton, located on the Colorado River near Bastrop, for the purpose of discussing with him the possibility of using pumped river water for the irrigation of his various pecan groves. Before the construction of the dams on the Colorado River there were times when it overflowed its banks and watered the pecan groves. Since then, the dams have prevented flood waters from overflowing the banks and the pecan groves have suffered from the loss of an abundance of water. It appears from my conversation with Mr. Barton that pecan trees have a long tap root and flourish best with the "feet" (roots) in water. To supplement the overflowed waters Mr. Barton plans to pump water from the river and irrigate an experimental tract of about 50 acres of pecans. He believes two irrigations of about 4 acre-inches per acre each will improve the quality and yield of pecans. He desires our assistance in his plans. I do not know of any information on the irrigation of pecans nor the water requirements for this particular crop. Many of the pecans I have purchased this year have not filled out, probably due to the lack of sufficient water and moisture for good growth.